Land Subject to Coastal Storm Flowage

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Definitions/Terminology

- Land subject to coastal storm flowage: means land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, whichever is greater. (310 CMR 10.04)
- 100 year storm = storm having a 1% chance of being equaled or exceeded in a given year.

Marshfield

Definitions/Terminology

- Special Flood Hazard Area means the area of land in the flood plain that is subject to a 1% chance of flooding in any given year as determined by the best available information, including, but not limited to, the currently effective or preliminary Federal Emergency Management Agency (FEMA) Flood Insurance Study or Rate Map (except for any portion of a preliminary map that is the subject of an appeal to FEMA) for Land Subject to Coastal Storm Flowage, the Velocity Zone as defined in 310 CMR 10.04, …

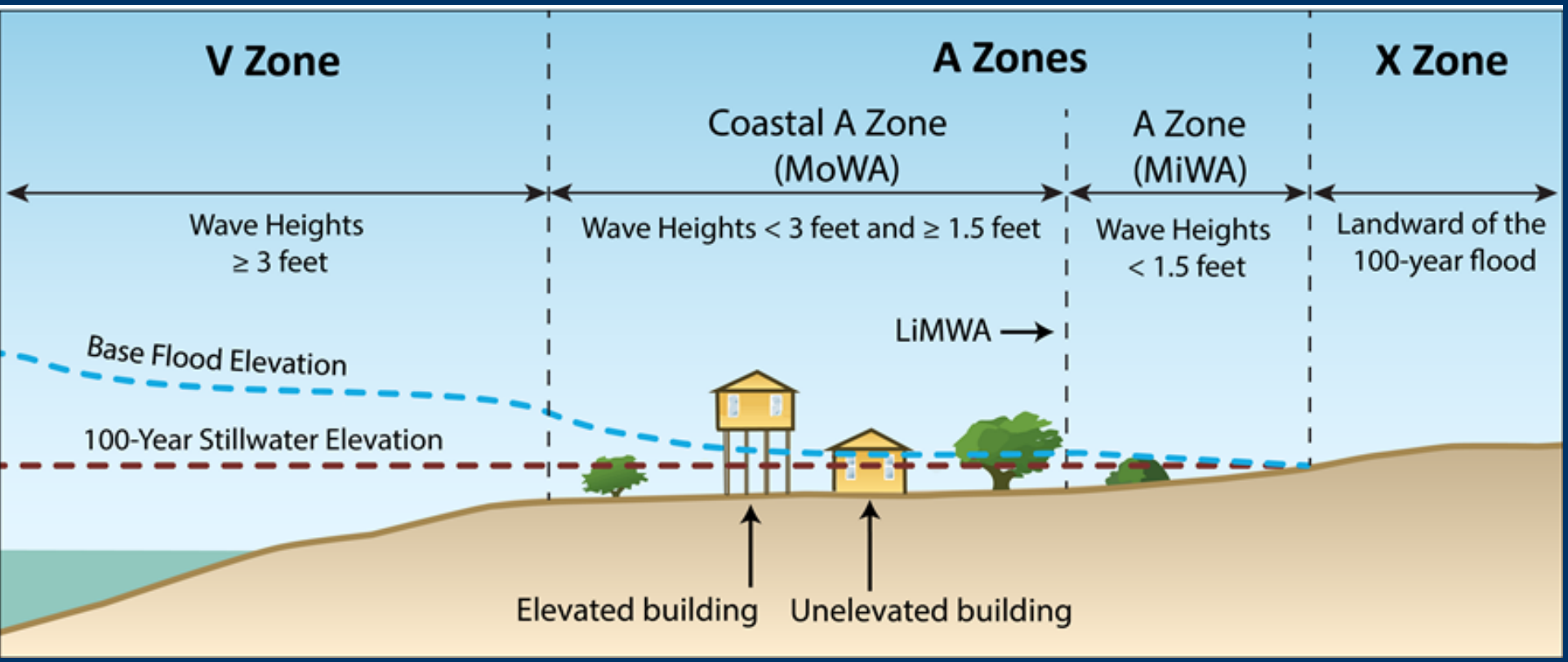
FEMA Flood Zone Definitions

- **Zone VE (V1-30) – Areas of 100-year coastal flood with velocity waves**
  - Wave height 3 feet or greater
  - Wave runup depth 3 feet or greater
  - Within primary frontal dune (first dune landward of the beach)
- **Zone AE (A1-30) – Areas of 100-year flood; flood elevations**
  - May be coastal or riverine
  - Coastal can contain up to 2.9 feet wave height
  - Coastal flood elevations at top of wave envelope
- **Coastal A Zone (MoWA) – Portion of the A Zone with 1.5 – 3.0' waves.**
  - Separated from the rest of the A Zone by the LiMWA
- **Zone AO – "Overwash" areas with flow depths of 1 to 3 feet**
  - Generally coastal with sloping ground
  - Flow velocities can vary greatly
  - Flow paths are typically not well defined
- **Zone A – Areas of 100-year flood; NO flood elevations given**
- **Shaded Zone X (B) – Areas of 500-year flood**
- **Unshaded Zone X (C) – "Areas of minimal flooding"**

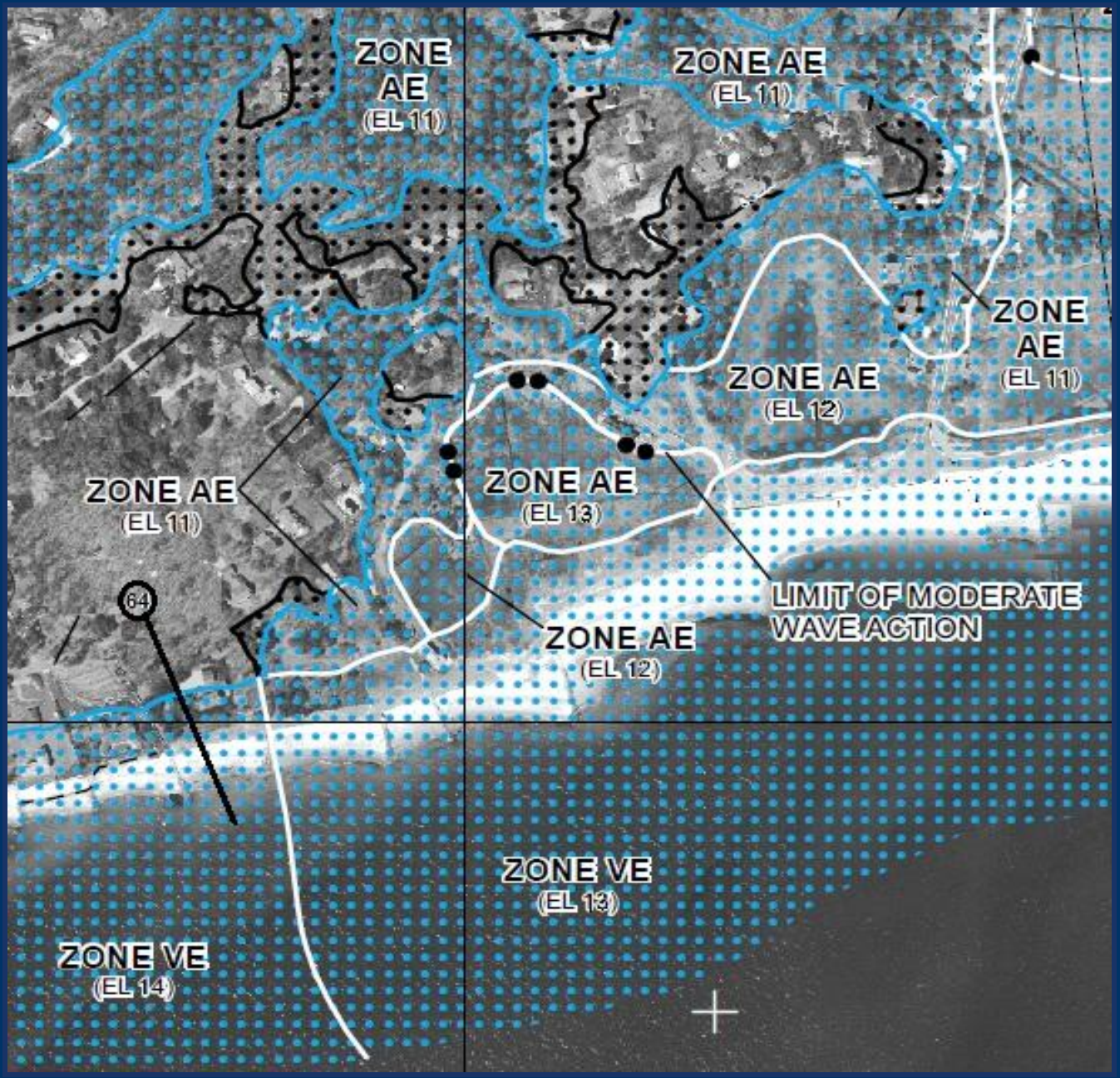
Coastal A Zones

- Coastal A Zone is a subset of the A Zone, separated from the rest of the A Zone by the Limit of Moderate Wave Action (LiMWA)
- Area where wave heights are 1.5’ – 3.0’
- FEMA has determined that buildings built to traditional A Zone standards receive structural damage under these conditions.
- MA Coastal A Zone Maps refine the delineations on the FIRMs to reflect the most current FEMA guidance for mapping Coastal A Zones.
- The proposed building code adopts more stringent standards for Coastal A Zones.

FEMA Flood Zones



Flood Insurance Rate Maps



MassDEP and Conservation Commissions should:

- Rely on MGL Ch 131, Sect 40 to establish authority. "No person shall remove, fill, dredge or alter any...land subject to… coastal storm flowage..."
- Presume that LSCSF performs functions for the storm damage prevention and flood control interests
- Assess how LSCSF functions at a project site
- Consider whether the project adversely impacts these functions and interests, and
- Impose conditions to contribute to the protection of the interests.

Storm Damage

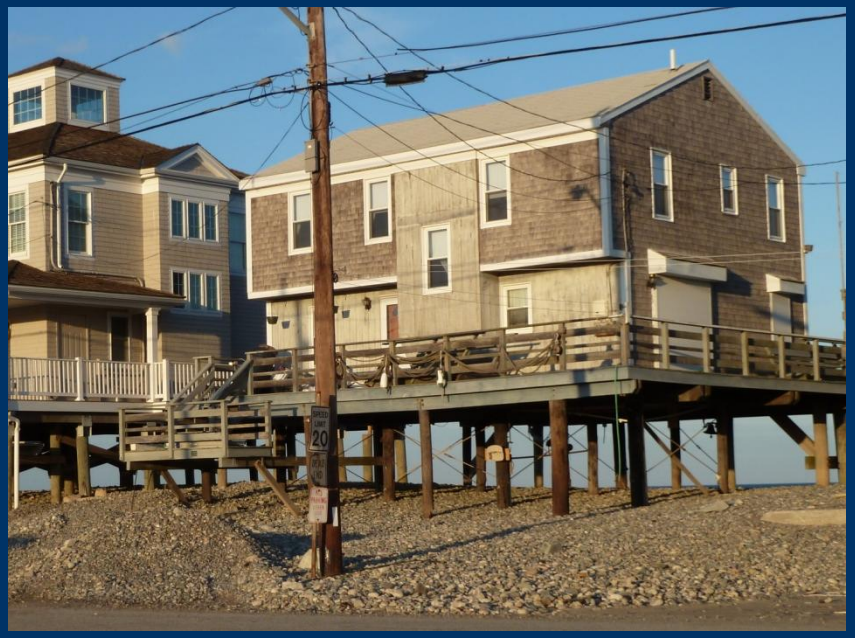
LSCSF functions to:

- Slow down flood waters, allow them to flow across a natural landform surface, and provide frictional resistance, thereby reducing their energy and destruction potential.
- When flood waters encounter obstructions, channelization of flood waters and storm-wave overwash occurs, increasing velocity and volume of flow to adjacent or landward areas.

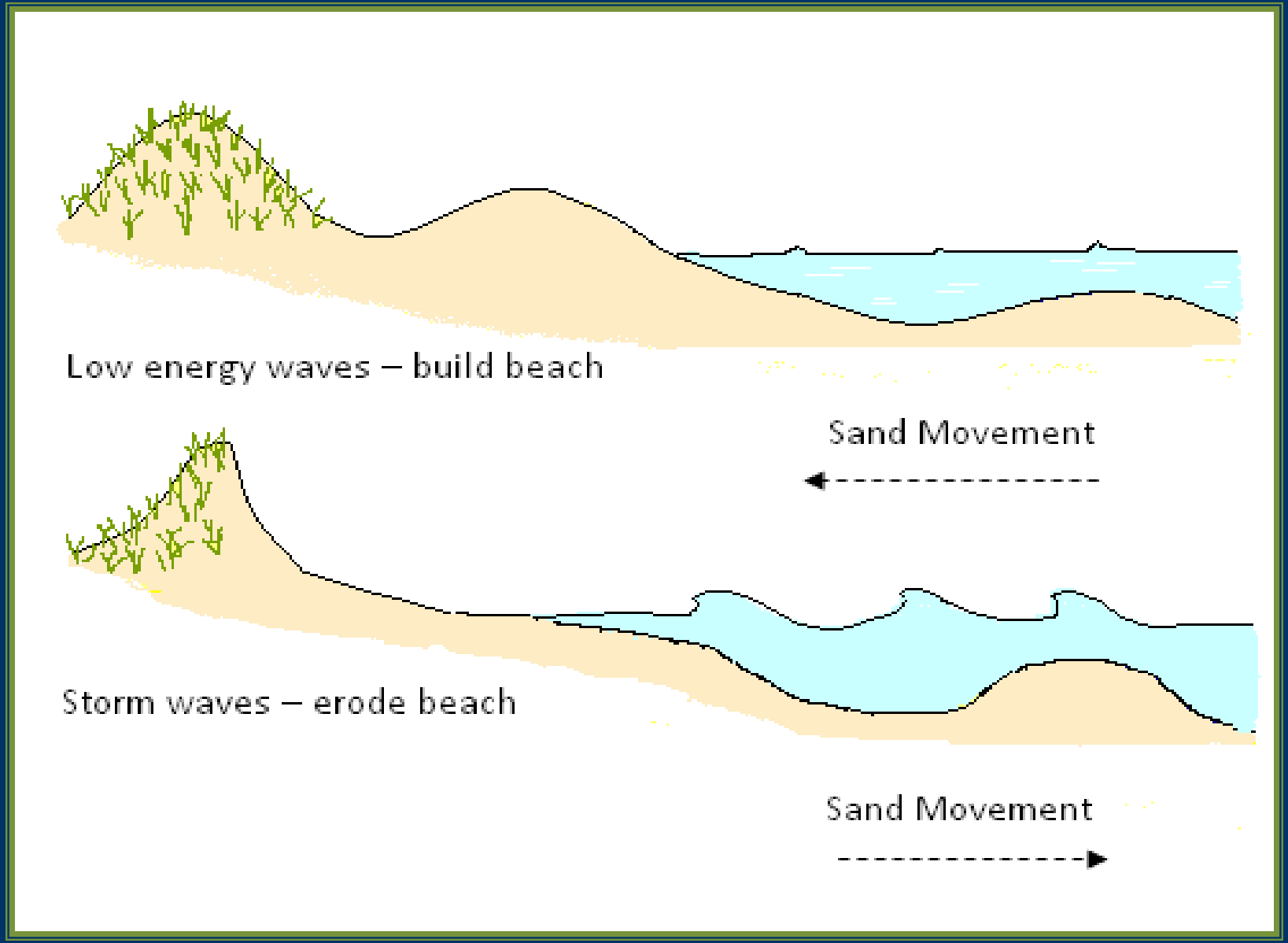
Scituate

LSCSF Function

- Allowing water to flow unimpeded under elevated buildings increases energy dissipation.
- Solid foundations deflect, reflect or redirect waves and flood water, channeling more water flowing a higher velocities onto adjacent resource areas, properties and public roads.
- Elevating the lowest structural above the FEMA Base Flood Elevation to account for sea level rise increases storm damage and flood control functions of LSCSF.



Function: Buffer Wave Action & Dissipate Energy



Function: Slow Down Flood Water

Characteristics important for this function:

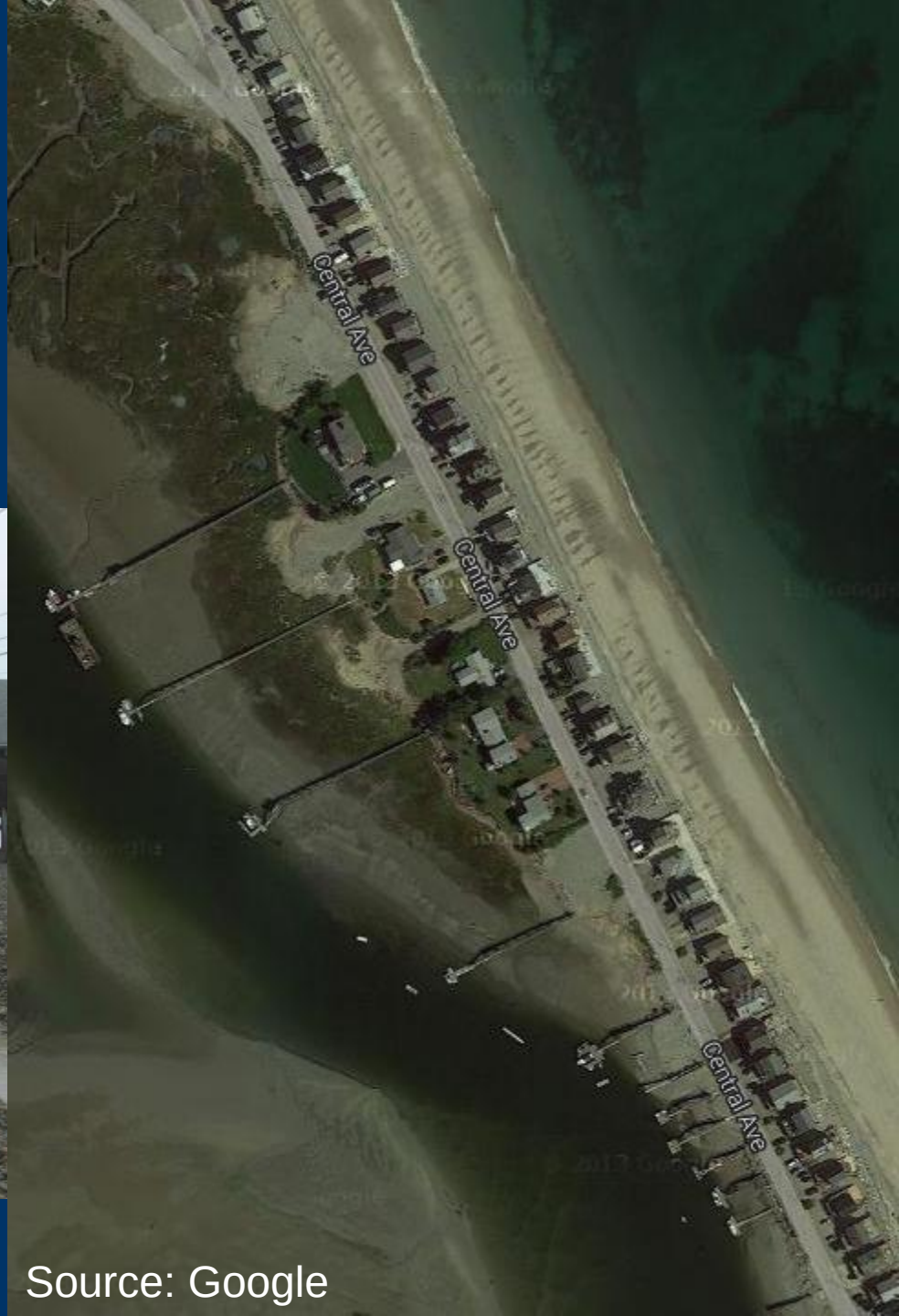
- Slope, soil characteristics, vegetation, erodability, permeability.

Reduces energy and destruction potential, protecting landward areas.

Function: Allow Flood Waters to Spread Over a Wide Area

Sediment transport reduces energy and storm damage

Scituate



Source: Google

LSCSF functions to:

- Allow flood waters to be detained, absorbed into the ground, or evaporated into the atmosphere.
- Protect the land from storm erosion by providing a substrate for vegetation that helps to stabilize sediments and slow down floodwater.

Reduced Function - Increased storm damage

Hull

Projects can diminish LSCSF functions:

Buildings on solid foundations and impervious surfaces in the floodplain may channel flood waters, with a higher velocity of flow to adjacent areas than natural materials.

Reducing vegetation and pervious areas reduces surfaces that can detain, absorb, slow, or evaporate waters, thereby changing the drainage characteristics in a manner that could cause increased flood damage on adjacent properties.

Obstructions to Flow: channelizes flood water, increase velocity of water

Flow Channels: Findings from FEMA Hurricane Sandy Report

Impacts of Flow Channelization

Flood Hazard Data: FIRM = Zone AE (5 feet)
ABFE = Zone V (10 feet)
Sandy floodwater elevation = 7 feet NAVD88

House washed into the bay at the site of flow channel A

Flood Hazard Data: FIRM = Zone AE (5 feet)
ABFE = Zone V (10 feet)
Sandy floodwater elevation = 7 feet NAVD88

Undermined house with damaged foundation between flow channels B and C.

Impacts of Flow Channels

Undermined house south of flow channel D.

Flood Hazard Data: FIRM = Zone AE (5 feet)
ABFE = Zone V (10 feet)
Sandy floodwater elevation = 7 feet NAVD88

Coastal Engineering Structures

- Coastal engineering structures often deflect, reflect and redirect storm waves, affecting adjacent properties and landward areas with wave energy, overwash and floodwaters.
- Erosion occurs seaward of the structures as a result of the wave reflection, and overtopping damages buildings and causes erosion landward of structures.

FEMA Hurricane Sandy Findings

Buildings within 10-20 feet of shore-parallel erosion control structures (e.g., seawall, bulkhead, revetment), overtopped by storm waves and/or surge during Hurricane Sandy were damaged, even when the erosion control structure survived.

Flood Hazard Data: FIRM = Shaded Zone X
ABFE = Zone V (16 feet)
Sandy floodwater elevation = 13 feet NAVD88

Flood Hazard Data: FIRM = Zone X
ABFE = Zone A (11 feet)
Sandy floodwater elevation = 11 feet NAVD88

Coastal Engineering Structures

Best management practices should be used to reduce wave reflection, overtopping, and damage landward of and adjacent to coastal engineering structures.

- Keep the CES as far landward as possible
- Address sources of upland runoff.
- Sloping structures dissipate wave energy better than vertical structures.

CES Best Management Practices

- Maintain the level of the beach seaward of the structure.
- Break the cycle of bigger structures.

CES Best Management Practices

- Minimize end effects on adjacent properties by pulling the structure back 15-20’ from the property line.
- Transition to adjacent properties.

LSCSF: Hydraulically Restricted Areas

Filling areas where water flow is restricted, such as where pipes, culverts, dikes, or other physical restrictions limit water flow may require compensatory flood storage.

Projects can diminish LSCSF functions:

- Dredging or the removal of materials within the coastal floodplain which results in greater water depth, allowing storm waves to break farther inland and to impact upland and wetland resource areas.

Environmental Consultants, MassDEP and Conservation Commissions should:

- Presume that LSCSF performs functions for the storm damage prevention and flood control interests.
- Assess how LSCSF functions at a project site
- Consider whether the project adversely impacts these functions and interests.
- Design projects or request design changes to protect the public interests.
- Impose conditions to protect the public interests, which are separate from what is protected by Building Code.

Case Study 1: Proposed Project in LSCSF

Background:

- Site mapped as A Zone on the FIRM
- BFE 13, ground elevation 10.
- Resource area LSCSF, buffer zone to coastal bank.

Proposed project: new house on a solid foundation with a paved driveway. Solid foundation may reflect waves and channelize flood waters around the foundation onto adjacent properties. Increased volume and velocity of water may increase storm damage to dwellings and town road landward of the site.

Alternatives to Reduce Impacts

- Minimize the project footprint
- Elevating the building on open pilings would allow flood water to flow unobstructed under the building (include sea level rise).
- Minimize removal of natural vegetation. Avoid or minimize lawn area.
- Prefer pervious surfaces (gravel, shell, pea stone) over new solid surfaces (pavement, concrete, pavers).
- Avoid fill that displaces flood storage capacity or redirects flow onto adjacent properties.

- Avoid new fences or retaining walls that would channelize moving water.

Case Study 2: Proposed Project in LSCSF

Background:

- A Zone, BFE 2’ above grade.
- Resource area: LSCSF

Proposed: House on a solid foundations with paved driveway.

Recommended: use of the existing unpaved road, or use of gravel, pea stone or shell to improve infiltration of floodwater.

Summary

- 25% of all NFIP claims occur outside the mapped flood zones.
- Human alterations in LSCSF can increase storm damage to adjacent private and public property.
- Storm damages are increasing in lower frequency events.
- Careful review of proposed projects in LSCSF is recommended.

Summary

- Storm of record can affect greater area than the mapped flood zones.
- More than half the buildings in NY City affected by Sandy were outside the mapped flood zones.
- Use best available information regarding actual extent of flooding in coastal storms.

References

- FEMA Mitigation Assessment Team Report: Hurricane Sandy in New York and New Jersey (November 2013)
- Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning.
- CZM StormSmart Coasts: mass.gov/czm/stormsmart
  - CZM Coastal Landscaping Website
  - StormSmart Properties Fact Sheets